What is claimed is:

[c1] A detector, comprising:
a first position sensitive radiation detector having a first radiation sensitive area and a second radiation insensitive area;
a first scintillator having a first decay time, located adjacent to the first radiation sensitive area; and
a second scintillator having a second decay time different than the first decay time, located adjacent to the second radiation insensitive area and being optically coupled to the first scintillator.

[c2] The detector of claim 1, wherein:
the first area and the second area comprise adjacent areas on a surface of the position sensitive detector; and
a first face of the first scintillator is connected to the first area;
a first face of the second scintillator is connected to the second area; and
a first edge of the first scintillator contacts a first edge of the second scintillator to optically couple the first and the second scintillators.

[c3] The detector of claim 2, wherein:
the position sensitive detector comprises a position sensitive photomultiplier tube (PS-PMT);
the second area comprises an edge of the PS-PMT detection surface; and
the first and the second scintillators comprise gamma ray sensitive scintillator crystals mounted to the PS-PMT detection surface.

[c4] The detector of claim 2, wherein:
the position sensitive detector comprises a solid state photodetector;
the second area comprises an edge of the photodetector detection surface; and
the first and the second scintillators comprise gamma ray sensitive scintillator crystals mounted to the photodetector detection surface.

[c5] The detector of claim 2, wherein the detector comprises a portion of a SPECT system.

[c6] The detector of claim 2, wherein the detector comprises a portion of a PET

system.

[c7] The detector of claim 6, further comprising:
a second position sensitive radiation detector having a first radiation sensitive area and a second radiation insensitive area;
a third scintillator having a third decay time, located adjacent to the first radiation sensitive area; and
a fourth scintillator having a fourth decay time different than the third decay time, located adjacent to the second radiation insensitive area and being optically coupled to the third scintillator.

[c8] The detector of claim 7, wherein:
the first and the second position sensitive detectors comprise a PS-PMT;
the second area comprises an edge of the PS-PMT detection surfaces; and
the first, the second, the third and the fourth scintillators comprise gamma ray sensitive scintillator crystals mounted to the PS-PMT detection surfaces.

[c9] The detector of claim 8, wherein:
the first position sensitive detector is located on a first detector ring of the PET detector;
the second position sensitive detector is located on a second detector ring of the PET detector, where the first ring is located adjacent to the second ring;
the second radiation insensitive area of the first position sensitive detector is located adjacent to the second ring; and
the second radiation insensitive area of the second position sensitive detector is located adjacent to the first ring.

[c10] The detector of claim 1, wherein the first decay time of the first scintillator differs from the second decay time of the second scintillator by at least 20 nanoseconds.

[c11]
The detector of claim 1, wherein:
the first scintillator emits radiation in the first radiation range based on receiving incident gamma rays;
the second scintillator emits radiation in the first radiation range based on

receiving incident gamma rays;
radiation emitted by the first scintillator is received by the first area of the position sensitive detector;
radiation emitted by the second scintillator propagates through the first scintillator and is received by the first area of the position sensitive detector; and
the first position sensitive detector is adapted to output a first electrical signal based on the radiation received by the first area.

[c12] The detector of claim 11, further comprising a processor electrically connected to the first position sensitive detector, wherein the processor is adapted to receive the first electrical signal, and to form a position sensitive image based on gamma rays received by the first and the second scintillators based on a difference between the first decay time and the second decay time.

[c13] A PET detection system, comprising:
a first detector ring;
a second detector ring adjacent to and coaxial with the first detector ring;
a first PS-PMT located on the first detector ring;
a second PS-PMT located on the second detector ring, adjacent to the first PS-PMT, such that a first edge area of the first PS-PMT detection surface is adjacent to a first edge area of the second PS-PMT detection surface;
a plurality of first scintillator pixels having a first decay time mounted adjacent to the detection surfaces of the first and the second PS-PMTs;
at least one second scintillator pixel having a second decay time different from the first decay time, mounted adjacent to each of the first edge area of the first PS-PMT detection surface and the first edge area of the second PS-PMT detection surface; and
wherein each of the second scintillator pixels are optically coupled to an adjacent first scintillator pixel.

[c14]
The system of claim 13, wherein:
the first scintillator pixels are located adjacent to radiation sensitive areas of the first and the second PS-PMTs detection surfaces;

the second scintillator pixel are located adjacent to radiation insensitive areas of the first and the second PS-PMT detection surfaces; and
a first edge of at least one first scintillator pixel contacts a first edge of at least one second scintillator pixel to optically couple the first and the second scintillator pixels.

[c15] The system of claim 14, wherein:
the first detector ring comprises a plurality of first PS-PMTs;
the second detector ring comprises a plurality of second PS-PMTs;
at least one column of a plurality of second scintillator pixels is mounted to the first edge areas of the first and the second PS-PMTs.

[c16] The system of claim 15, further comprising:
a third detector ring adjacent to and coaxial with the second detector ring;
a third PS-PMT located on the third detector ring, such that a first edge area of the third PS-PMT detection surface is adjacent to a first edge area of the second PS-PMT detection surface;
a plurality of first scintillator pixels having a first decay time mounted adjacent to the detection surface of the third PS-PMT;
a plurality of second scintillator pixels having a second decay time different from the first decay time, mounted adjacent to the first edge area of the third PS-PMT detection surface; and
wherein at least one second scintillator pixel is optically coupled to an adjacent first scintillator pixel.

[c17] The system of claim 14, wherein:
the first scintillator pixels emit radiation in response to receiving gamma rays;
the radiation sensitive areas of the first and the second PS-PMTs are adapted to receive radiation from the first scintillator pixels;
the second scintillator pixels emit radiation in response to receiving gamma rays;
the radiation sensitive areas of the first and the second PS-PMTs are adapted to receive radiation from the second scintillator pixels through adjacent optically coupled first scintillator pixels; and

the first and the second PS-PMTs are adapted to output an electrical signal based on radiation received in the respective radiation sensitive areas.

[c18] The system of claim 17, further comprising a processor which is adapted to receive an electrical signal from the first and the second PS-PMTs and to form a position sensitive image from the received signals based on a difference between the first decay time and the second decay time.

[c19] The system of claim 13, wherein the first decay time differs from the second decay time by at least 20 nanoseconds.

[c20] The system of claim 19, wherein:
the first scintillator pixels are selected from a group consisting of MLS, BGO and LSO;
the second scintillator pixels are selected from a group consisting of MLS, BGO and LSO; and
the scintillator material of the first scintillator pixels is the same or different from the scintillator material of the second scintillator pixels.

[c21] The system of claim 13, wherein:
there are no detection gaps between the first detector ring and the second detector ring; and
the first and the second scintillator crystals are coupled to the respective first and second PS-PMTs without optical fibers.

[c22]
An imaging method, comprising:
receiving electromagnetic radiation at a first scintillator from a radiation source;
emitting first radiation from the first scintillator having a first decay time;
receiving the first radiation at a first radiation sensitive area of a first position sensitive radiation detector;
receiving electromagnetic radiation at a second scintillator from the radiation source;
emitting second radiation from the second scintillator having a second decay time different than the first decay time;
propagating the second radiation through the first scintillator to the first

radiation sensitive area of the first position sensitive radiation detector;
distinguishing a difference between the first decay time and the second decay time; and
forming a position sensitive image from electromagnetic radiation received by the first and the second scintillators based on the difference between the first decay time and the second decay time.

[c23] The method of claim 22, wherein the step of distinguishing a difference between the first decay time and the second decay time comprises distinguishing a difference between the first decay time and the second decay time by using a signal integration method.

[c24] The method of claim 22, wherein the step of distinguishing a difference between the first decay time and the second decay time comprises distinguishing a difference between the first decay time and the second decay time by using a signal branching method.

[c25] The method of claim 22, wherein:
the electromagnetic radiation comprises gamma rays;
the first position sensitive detector comprises a PS-PMT;
the first scintillator is mounted adjacent to the first radiation sensitive area of a detection surface of the PS-PMT;
the second scintillator is mounted adjacent to a second radiation insensitive area of the detection surface of the PS-PMT.

[c26] The method of claim 25, further comprising:
outputting a first electrical signal based on the first and the second radiation received by the first area of the first position sensitive radiation detector; and
receiving the first electrical signal at a processor.

[c27] The method of claim 26, further comprising:
receiving electromagnetic radiation at a third scintillator from a radiation source;
emitting first radiation from the third scintillator having a first decay time;
receiving the first radiation at a first radiation sensitive area of a second

position sensitive radiation detector;

receiving electromagnetic radiation at a fourth scintillator from the radiation source;

emitting second radiation from the fourth scintillator having a second decay time different than the first decay time;

propagating the second radiation through the third scintillator to the first radiation sensitive area of the second position sensitive radiation detector;

outputting a second electrical signal based on the first and the second radiation received by the first area of the second position sensitive radiation detector;

receiving the first electrical signal at a processor;

forming the position sensitive image based on the first and the second electrical signals.

[c28] The method of claim 27, wherein:

the first position sensitive detector is mounted onto a first detector ring of a PET system; and

the second position sensitive detector is mounted onto a second detector ring of the PET system, where the second detector ring is adjacent and coaxial with the first detector ring.

[c29] The method of claim 28, wherein the electromagnetic radiation comprises gamma rays are emitted by a human or an animal.